Student Centered Learning in Uganda: Mwalimu Mobile Web Open Education Resource Platform

By Onen Simon, Oryono Patrick Ken and Draku Henry

A Report Submitted to the Department of Computer Science - Faculty of Science, for the Study Leading to Project in Partial Fulfillment of the Award of the Degree of Bachelor Computer Science of Gulu University.

[May,] [2015]

Declaration

We members of this group hereby declare that the project entitled "Mwalimu Mobile Web Open Education Resource Platform" submitted for a "Degree in Computer Science" is our original work and the project has not formed the basis for the award of any degree.

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Gulu University

May 2015

Group Membership

Names	Registration Number	Signature
Onen Simon	13/U/0178/GCS	
Oryono Patrick Ken	13/U/0111/GCS	
Draku Henry	13/U/2136/GCS/PS	

Dedication

We dedicate this project to our parents who have always been there for us. Thanks to you our friends who supported us right from the beginning of the project. We also thank the Almighty God who kept us alive all this time.

Acknowledgement

We express and attribute our sincere thanks to the Almighty God who has provided us with wisdom and kept us alive.

We would like to thank our supervisor Mr. Byabazaire John for the directions and guidance he has given to us during the development of this project. We would also like to acknowledge the contributions of Dr. Benedict Oyo and Mr. Byabazaire John who came up with the idea and participated in the building of a student centered learning platform called Mwalimu Open Educational Resource.

We also thank our colleagues who have helped in successful completion of the project.

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List of Acronyms

CS4HS   Computer Science for High School

MoES   Ministry of Education and Sports

UNESCO   United Nations Educational, Scientific and Cultural Organisation

OER   Open Education Resource

ICT   Information Communication and Technology

ELATE   ELearning and Teacher Education

OECD   The Organisation for Economic Cooperation and Development

SCL   Student Centered Learning

UCE   Uganda Certificate of Education

UACE   Uganda Advanced Certificate of Education

PLE   Primary Leaving Examinations

MOOC   Massive Open Online Course

DTC   Department Training College

PTC   Primary Teachers College

USE   Universal Secondary Education

UPE   Uganda Primary Education

KCS   Kenya Cloud School

CSCL   Computer Supported Collaborative Learning

MUELE   Makerere University E-learning Environment

UCC   Uganda Communication Commission

UNEB   Ugandan National Examinations Board

Abstract

The education system in Uganda is evolving steadily fast with the use of ICT in schools even if it is faced with a number of short comings which include inadequate teaching/learning resources in secondary schools due to inadequate computer resources and low Internet bandwidth that considered the biggest nightmare for access of e-resources in developing countries. The study looked at the effect of OER on academic performance in secondary schools of Uganda Education and Sports jointly with Uganda Communications Commission (UCC) have made significant effort to provide the state-of-the-art thin client computers and Internet in all public secondary schools irrespective of their geographical locations. In rural areas where there is no electricity, the computers are powered by solar energy. In contrast, the Mwalimu Mobile web educational resource that was developed by the students of Gulu University Draku Henry, Oryono Patrick Ken and Onen Simon under the supervision of the pioneer and initial developers of the Mwalimu OER platform, Mr. John Byabazaire promise to empower students to learn at their own pace with less dependency on teachers. This study presents the Mwalimu mobile web open educational resource, as a new platform for student centered learning in Uganda whereby students do not only access available content but also contribute to the content pool under the principle of crowdsourcing. The content is structured under four areas including: notes, video lessons, questions and answers, and examinations and solutions and accessible on the mobile devices. A part from the examinations and solutions that are exclusively provided by the subject consultants, the rest of the content is sourced from the crowd (students, teachers and the public).

Chapter 1

Introduction

Nelson Mandela said "Education is the most powerful weapon which you can use to change the world". The academic board of secondary education in Uganda (UNEB) has failed to adopt a simple, comprehensive, normative methodology for categorizing, designing, developing and evaluating an online e-learning tool for its students. Following the 1990 Jomtien worldwide education conference (UNESCO 1994), Uganda demonstrated commitment by introducing universal primary education (UPE) in 1997. Following the inauguration of UPE in 1997, pupils' enrollment in all UPE schools shot up from 3.4 million to over 5.4 million, and then to over 7.0 million by 2002 (Murphy 2003). The government of Uganda's commitment to providing free education to four children per family at the primary subsector level helped contribute to this sharp rise in students' enrollment. There was great success in terms of seeing more children attending primary schools irrespective of the challenges arising from the inadequate infrastructure, shortage of well-trained teachers, and paucity of instructional materials. These challenges have tended to compromise the overall quality of education being offered especially by UPE schools. This is reflected in the high dropout rates after the primary education cycle. A substantially smaller number of students who graduate from their primary level schooling continue on for secondary education. Some argue this is a relative waste of limited financial resources in terms of the government's investment in UPE. For example, in the year 2000 of all the secondary school eligible age cohort only 13 percent registered/enrolled for secondary education. Secondary education is still highly skewed towards the higher income groups especially those coming from urban families (Ministry of Education and Sports [MOES] 2005).

Due to loss of instructional time due to off-task behavior is a well-established problem in educational settings, recognized both by researchers (e.g., Baker, 2007; Karweit & Slavin,1981; Lee et al., 1999) and practitioners (e.g., Lemov, 2010) for over a hundred years (cf. Currie, 1884 as cited in Berliner, 1990). OER is a better way for students.

However, after registering some success particularly in terms of students' enrollment in the now 13-year-old UPE project it seemed logical to introduce universal secondary education (USE) in Uganda. Government policy makers and planners hoped that by introducing USE enrollments would increase and there would be a minimized gender and rural-urban divide at the secondary subsector school level. Already in 2007, Uganda witnessed an influx of over-

flowing numbers of students in enrolling USE schools thus exerting pressure on the system in terms of school infrastructure (classroom space, offices, and teacher housing), trained teachers, and limited financial resources (MOES 2008). In recent years that has formed the basis for the establishment of the E-learning and Teacher Education (ELATE) Programme

The 2040 vision of Uganda is to transform the Ugandan society from a peasant to modern, prosperous and competitive upper middle-income country. This vision is not possible due to the increasing numbers if illiteracy and low development rates of science and technology and this can be improved by access training right from kindergarten and primary to higher institutions of learning. Gulu University, Makerere University, Gayaza Girls school have enunciated a commitment to infusing the teaching-learning process with appropriate Information and Technology through OER. This focus is to provide students with online free (open) education content to enable them learn without constraint interaction with teachers. With the fact that current education system which is teacher centered favours students from urban centers that can afford qualified and experienced teachers as opposed to schools in rural areas. In 2012, MoES introduced a subsidiary in computer studies for Secondary Education (A'Level) which is compulsory. This was to help the students and teachers to learn and be trained in necessary ICT skills. In support the government of Uganda under UCC has funded the construction of various computer laboratories that is the Cisco labs.

1.1 Background of Secondary School Education in Ugandan

Uganda's Secondary education system follows the education system of its former colonial masters, Britain. It is divided into the Ordinary Level (O 'level) and Advanced level (A 'level). The lower secondary consists of Senior One to Senior four and four years of schooling at the end of which students undertake O-level exams in at least eight subjects with maximum of ten subjects. These subjects include seven compulsory ones, i.e., English, Mathematics, Chemistry, Biology, Physics, Geography, and History, and other optional subjects: Computer, Technical Drawing Commerce, Religious Studies, Agriculture, Fine Art and Literature. At the end of S4, national examinations are done leading to an award of Uganda Certificate of Education (UCE). Furthermore, students with good grades in UCE proceed to A' Level (Senior Five and Senior Six) where three subject combinations for sciences or arts subjects are offered. Students with subject combinations having economics offer additional Subsidiary Mathematics and the rest offer ICT. On the other hand, students with weak grades at UCE or those who cannot afford A' Level fees, either enroll for vocational training or primary teacher training. The rest simply drop-out.

Furthermore, Upper secondary consists of two years of schooling at the end of which you sit A-level exams in at least three subjects. At end of S6, students do a final set of national examinations leading to an award of Uganda Advanced Certificate Education (UACE). Again good grades at UACE would guarantee public sponsorship at university level. The government sponsors the top 4000 students in UACE examinations in public universities such as Gulu University,

Makerere University, Muni University, Kyambogo University, Busitema University, Mbarara University of Science and Technology. The rest of the students who can afford fees may choose to enroll in public or private universities such as Uganda Christian University, Nkumba University. The majority of the poor students drop-out of education at this stage.

The curriculum for lower secondary is currently being reviewed by the National Curriculum Development center and a new curriculum is expected to roll out in 2015.

Three year technical schools provide an alternative to lower secondary school. Alternatives for graduates from lower secondary school include: 2-3 year Technical Schools; 2 year Primary Teacher Colleges (PTC); Department Training Colleges (DTCs) and upper secondary schools such as St. Mary's College Kisubi, Namilyango College, St. Henry's College Kitovu among others.

1.1.1 The access to Education

Getting access to education in the first place can be a huge challenge. In 1997 the Ugandan government introduced UPE (the idea that all children should be able to attend primary school for free) and in 2007 USE. Unfortunately the demand for free education outstrips the availability of places at the free government schools. It is not uncommon for classes to have well over one hundred students, with very little in the way of facilities and demotivated, over worked teachers heading them. This means that for most of the population, especially for those who want a high quality of education, the only other option is private school. In Uganda, private schools vary enormously in fess and quality.

Paying school fees is beyond many families, especially where they have a lot of children. This means that many children are left sitting at home, waiting for their relatives to try scrape together enough money to send them back to school. However, matters are made worse by the fact that at all schools there many extra school requirements to pay for on top of fess. From brooms to school books and uniform and smart shoes, each child must turn up at the gates with everything asked of them, or else risk being sent back home.

It is a seemingly impossible task for many children and their families to fund an education, and a lot of children manage to pay part of their fees. This is a common occurrence, and however hard a child has worked at school, if they cannot pay their fees in full they are not given their school reports or exam certificates. Their whole year of learning is effectively made worthless. Consequently, many children end up changing schools every term, building up debts wherever they go as they can simply cannot afford to pay them.

1.1.2 Computer access in schools

Access of computers has increased drastically as compared to the previous years. This has been due to the introduction of ICT in Secondary schools. This has forced all schools including rural schools to access ICT equipment to facilitate the teaching.

Most students in schools now have access to their mobile phones of which they can now access these web almost frequently.

1.2   Problem Statement

The education system in Uganda requires students to access information directly in class. However this has number of limitations such as incompetent teachers, bad attitude of students towards some teachers and schools, lack of access to internet web resources and research activities out of class and ICT services.

Inorder to reduce the limitations that arise from this type of education system, the mobile version of the Mwalimu OER platform needs to be developed. This will be possible through provision of quality information, notes, tutorials, exam questions via their mobile devices at anytime.

1.3   Main Objective

The aim of this study was to adopt a simple, comprehensive, normative methodology for categorizing, designing, developing and evaluating an online free e-learning tool for students and teachers. This was also to provide and strengthen the use of free online courseware in teaching and learning in Ugandan Secondary Schools on mobile devices and computers. As a result a mobile version of the Mwalimu OER has been developed. The following specific objectives were explored.

1.3.1   Specific Objectives

This study addressed the following objectives:

- To reduce on loss of instructional time due to off-task behavior.

- To increase and familiarize the use of mobile hand-held devices such as smart-phones, tablet computers

- To support student centered learning.

- To promote crowd sourcing of content as a means of assimilating small contributions into high quality content.

- To promote open access to content not only on computers but also mobile devices.

1.4   Scope

This study was focused only on Mwalimu OER desktop version . The desktop version of the platform provides four content areas which are Notes content space, Questions and answers space, Examinations and solutions space, Video lessons space.

In the mobile version the four content areas are Book bank, Video bank, Exam bank, Question Answer bank in the respective vertical order.

- Book bank. This content area provides users with the ability to add notes and also filter them basing on subjects and topics.

- Video Bank. Under this content area, students are able to view video tutorials, upload and download video various video tutorials for later viewing.

- Exam Bank. This content area requires authorisation and must be accessed by only consultants.

- Question Answer Bank. This allows users to enter questions according to their subject and topic of interest and submit the questions.

1.5 Significance

The significances of the study are as follows:

- The mobile platform enables access to education resource such as notes, video tutorials and exam papers at anytime.

- The platform also reduces the expenses on educational materials for students.

- This platform promotes crowdsourcing of content

Chapter 2

Literature Review

2.1 Introduction

Of recent there has been an increase in the use of mobile devices to access internet services such as web applications and web sites. These greatly promote the mobile web version of the Mwalimu OER.

The background of this research and brief description of the study settings were introduced in the previous chapter. This section will continue on the discussion and ideas in previous work and knowledge related to Mwalimu mobile web platform.

2.2 State of the art

2.2.1 Mobile web technology

According to Turban *at el* (2007), Mobile technologies potentially create a wide variety of uses and limitations that differ significantly from desktop and laptop technologies. Dankers *at el* (2002), found thatr today most people are equipped with mobile devices and most of them already have a good knowledge and experiences in using mobile devices to access internet applications.

2.2.2 Open Education Resource

The idea of open educational resources (OER) has numerous working definitions. The term was firstly coined at UNESCO's 2002 Forum on Open Courseware and designates "teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no cost access, use, adaptation and redistribution by others with no or limited restrictions. Open licensing is built within the existing framework of intellectual property rights as defined by relevant international conventions and respects the authorship of the work". Often cited is the William and Flora Hewlett Foundation term which defines OER as: "teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others. Open educational resources include full courses, course

materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge".

The Organization for Economic Co-operation and Development (OECD) defines OER as: "digitised materials offered freely and openly for educators, students, and self-learners to use and reuse for teaching, learning, and research. OER includes learning content, software tools to develop, use, and distribute content, and implementation resources such as open licenses". (This is the definition cited by Wikipedia's sister project, Wikiversity.)

By way of comparison, the Commonwealth of Learning "has adopted the widest definition of Open Educational Resources (OER) as 'materials offered freely and openly to use and adapt for teaching, learning, development and research' ".The WikiEducator project suggests that OER refers "to educational resources (lesson plans, quizzes, syllabi, instructional modules, simulations, etc.) that are freely available for use, reuse, adaptation, and sharing'

The above definitions expose some of the tensions that exist with OER:

- Nature of the resource: Several of the definitions above limit the definition of OER to digital resources, while others consider that any educational resource can be included in the definition.

- Source of the resource: While some of the definitions require a resource to be produced with an explicit educational aim in mind, others broaden this to include any resource which may potentially be used for learning

- Level of openness: Most definitions require that a resource be placed in the public domain. Others require for use to be granted merely for educational purposes, or exclude commercial uses.

At the same time, these definitions also share some universal commonalities, namely they all:

- cover both use and reuse, repurposing, and modification of the resources;

- include free use for educational purposes by teachers and learners

- Encompass all types of digital media.

2.2.3 Student Centered Learning

Theorists like John Dewey, Jean Piaget, and Lev Vygotsky, whose collective work focused on how students learn, have informed the move to student-centered learning. Carl Rogers' ideas about the formation of the individual also contributed to student-centered learning. Rogers wrote that "the only learning which significantly influences behavior [and education] is self-discovered". Maria Montessori was also a forerunner of student-centered learning, where preschool children learn through independent self-directed interaction with previously presented activities.

Self-determination theory focuses on the degree to which an individual's behavior is self-motivated and 'self-determined'. When students are given the opportunity to gauge their learning, learning becomes an incentive.

SCL means inverting the traditional teacher-centered understanding of the learning process and putting students at the center of the learning process. In

the teacher-centered classroom, teachers are the primary source for knowledge. On the other hand, in student-centered classrooms, active learning is strongly encouraged. Armstrong (2012) claimed that "traditional education ignores or suppresses learner responsibility".

A further distinction from a teacher-centered classroom to that of a student-centered classroom is when the teacher acts as a facilitator, as opposed to instructor. In essence, the teacher's goal in the learning process is to guide students into making new interpretations of the learning material, thereby 'experiencing' content, reaffirming Rogers' notion that "significant learning is acquired through doing".

2.2.4 Crowdsourcing of academic content

Crowdsourcing is the process of assimilating many small contributions into resources of high quality (Corneli and Mikroyannidis, 2012). Crowdsourcing is underpinned by Page's (2008). "Diversity Trumps Ability" theorem which posits that diverse groups of people have different ways of seeing a problem and thus faster and better ways of solving it. One of the fascinating examples of crowdsourcing of academic content is the "crowdsourcing a textbook" project by Professor Gehringer of North Carolina State University, that involved 120 students working together to create a textbook for computer science and computer engineering class. As is pointed out by Gehringer (2011), in the project the group used open software Expertisa and were guided by deadlines and expectations for review and revision, wiki workspace and coordinated writing of sequential chapters, different types and stages of feedback including anonymous peer reviews, and instructor and teaching assistant editing. As pointed out by Gehringer (2011), the most important factor why educational organizations need wiki textbooks is the feel of ownership students get after participating in such projects.

2.3 Adoption Trends of Computers in Africa

Computers have long been viewed as a potential solution to Africa's education challenges. However, the devices necessary to enable eLearning have previously been too expensive, too power-hungry (on a continent known for its lack of infrastructure), and too reliant on scarce technical skills to practically implement. Over the last few years, however, an inflection point has been reached as three trends – the reduced cost of computing devices, reduced power consumption of devices, and availability of off-grid power - converge to dramatically reduce the cost of large deployments.

This makes eLearning feasible as a large scale solution to Africa's education challenges. These trends will also allow Africa to leapfrog developed world education solutions by using e-content, low cost devices, cloud computing, and renewable energy sources. There's more, however. New eLearning models, enabled by greater availability of quality content that is easily customizable, can offer a much wider range of learning experiences to improve education outcomes.

This is especially important given not only the vast and remote geographies typical of Africa, but the broad range of groups and individuals that will connect in different ways and in different environments (e.g., Internet café, at home, at
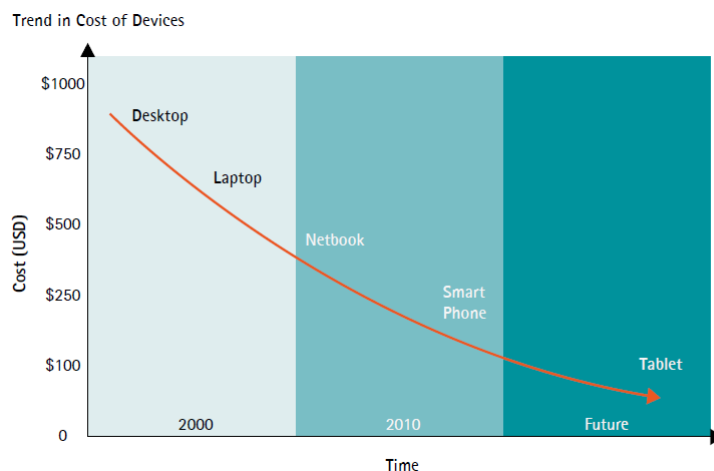
Figure 2.1: Trend in costs of devices

school, via mobile devices). Each group will require different content, and will prefer different types of teacher/student interactions.

It is thus important that governments and organizations focus not only on the enabling technologies but carefully consider which eLearning models they need to implement. To do so, eLearning infrastructure, potential leapfrogging opportunities, and the characteristics and benefits of new eLearning models must be integrated to create a holistic, flexible, scalable and sustainable solution

This trend is likely to continue, with laptops, mobile devices and touchscreen tablets costing less than $100 over the next two to three years. These new devices will also enable a much improved user experience and connectivity capacity, opening up new modes of eLearning for education.

2.4 Learning and teaching with ICT

The rapid advances recently made in ICT, have very important implications for the students and teachers of Uganda. Many educationists in their initial attempt to use the Internet have merely used it to provide on-line materials to students primarily as information resources. (Harper, Hedberg, Bennett, & Lockyer, 1999).

Research suggests that teaching and learning with ICTs enables students to spend more time involved in collaborative work, participate in more project-based instruction, produce writing of higher quality and greater length, gain increased access to information, improve research analysis skills, and spend more time doing homework on computers (Gulek and Demirtas, 2005).

However the Mwalimu Mobile web OER provides a platform for embedding instructional content in the technology and then delivered to the student with the assumption that if you deliver content the students will learn. But by blending the use of technology with teaching by the teacher, students have been shown to have much higher learning outcomes.

2.5 Related Systems

There are a number of applications that support online learning. These range from the generic LMS such as Moodle, eFront, and Blackboard to more specialised ones. This section focuses on the latter category in the context of Africa, which is consistent with Mwalimu OER

2.5.1 Uganda Context

Uganda is holding a secret. It is host to one of the largest implementations of eLearning in Africa to date. From urban uptown schools to village schools. Already in 2005 the Ministry of Education and Sports agreed to a pilot in 10 government secondary schools, deploying computerized Science and Mathematics software and virtual laboratory software. Having reached 250 schools, the ministry then joined hands with the Uganda Communications Commission (UCC), and the software by now has been installed in 750+ secondary schools – all over Uganda.

2.5.1.1 Cyber School Technologies Solution

Cyber School Technology is a premier provider of quality educational services offering world-class solutions to enhance the online educational environment globally. The one-stop-site for development, e-learning, communication solutions, Cyber School Technology works with experienced educators and technocrats across the globe in designing and developing digital educational resources, portals and learning management systems for improved communication and easy access to syllabus-specific lessons on Science and Mathematics. Be it digital content on 3D, online tutoring services, ICT courses or School Online Information Systems, all our products, educational tools, training and support material and services are well-researched and tested, providing appropriate solutions to achieve student success at all levels.

2.5.1.2 Elearning and Teacher Education

This article draws upon the experiences gained from the ELATE Programme, which was a collaborative teacher professional development initiative between Makerere University (Uganda) and the Open University (UK). ELATE engages in the development of open education resources (OERs) to support teachers and is disseminated via three primary mediums: online through its web portal; via CD-ROM distribution, especially in contexts where Internet access is limited or non-existent; and by hard-copy instruction materials. Since its establishment in 2007 ELATE has included parallel action-research centered on the following four objectives:

1. Raise the effectiveness of teacher training in Uganda by enabling trainers to enhance their capabilities through working together with other education stakeholders, including school and private sector employers.

2. Create OERs for trainees and practicing teachers in secondary schools to raise their effectiveness and employability while also helping to raise the proportion of qualified students graduating from secondary education and reducing "drop-outs."

3. Disseminate teacher guidance and learning materials that make the school classroom experience more active, engaging, and locally relevant.

2.5.1.3   Gayaza Girl's High School elearning platform

Gayaza High School is one of the top schools in Uganda. It is a boarding girl's school situated in central Uganda about 10 kilometers from the capital city Kampala. Gayaza High School was the first school to initiate content sharing over the Internet. The school received support from Microsoft and Mobile Telecom Network (MTN) Uganda in support of their eLearning initiative. Currently their eLearning platform (http://etutoring.gayazahs.sc.ug/) covers educational exercises, notes and videos. Due to diminishing incentives for content development, the content throughput on this platform is dropping.

2.5.1.4   UCU e-learning platform for Uganda Christian University

Uganda Christian University is one of the leading christian universities in Uganda and with it it has a complete e-learning platform which requires students to login and access educational content. http://e-learning.ucu.ac.ug/login/index.php.

2.5.1.5   MUBS e-learning platform (musep) for Makerere University Business School

Musep is an elearning platform of the most popular business institute for higher education that mainly centers on training its students on this platform which is accessed via the following url http://mubsep.mubs.ac.ug

2.5.1.6   KIU e-learning platform for Kampala International

Kampala International University is a higher institute for higher education whose elearning platform is accessed via this url http://kiu.ac.ug/elearning or by clicking the elearning link on the University's website.

2.5.1.7   Makerere University E-Learning Environment

Makerere University is the leading institutions for higher education in Uganda and it already has an e-learning environment which can be accessed on (http://muele.mak.ac.ug). This platform offers notes, video tutorials, time tables and it is on this same platform that students can access course works and assignments submitted by lecturers.

Chapter 3

Methodology

The methodology used in our research mainly centers on the research design and other activities such as formulating a problems statement and motivation, identifying and defining the objectives for a solution, design and development, demonstration, searching and selection procedures which helped us in our research design.

3.1 Research design

Our research design was done basing on various activities such as e-learning methodologies, formulating a problems statement and motivation, identifying and defining the objectives for a solution, design and development and many more which we listed and explained an in depth of how each activity helped us to address the problem statement clearly.

3.2 Research activities

The building of the mobile web application version for the Mwalimu open educational resource that will be accessed via all hand-held mobile phone devices such as smart-phones, tablet computers, Personal Digital Assistants PDAs, palm tops required our team to carry out and perform the following research activities

3.2.1 Formulation of a problems statement and motivation

The idea of building a mobile web application version for the Mwalimu open educational resource came due to the evolution of the web that is making almost every platform on the web to turn into mobile and also as a result of the increasing use of hand-held mobile devices such as smart-phones due to their significant drop in prices that has made these devices cheap such that they can be owned by almost the majority of people within different communities in the world. This was also because of the increased accessibility of Internet services and data connectivity in third world countries like those in Africa, which is now relatively affordable to most individuals most especially students carrying out research. Initially the idea of the Mwalimu OER desktop version was conceived following a Google CS4HS founded workshop for ICT teachers in 2012.

3.2.2 E-learning methodologies

E-learning exploits Web technology as its basic technical infrastructure to deliver knowledge. As the current trend of academic and industrial realities is to increase the use of e-learning, in the near future a higher demand of technology support is expected. In particular, software tools and web-platforms supporting the critical task of instruction design should provide automated support for the research, analysis, design, documentation, implementation, and deployment of instruction via Web.

3.2.2.1 Interaction in Learning

Learner(s) -Tutors(s) Interaction, and Learner(s) –Learner(s) Interaction: these two types of interactions are among humans, and they are the interaction forms that people are most familiar with. Therefore, our research studies focused on these two types of interaction, especially in the research of Computer Supported Collaborative Learning (CSCL). According to CSCL, if collaboration rather than individual learning designs were used in an on-line class, students should be more motivated to actively participate and should perceive the medium as relatively friendly and personal as a result of the on-line social interactions. This increased active group interaction and participation in the on-line course, hence, resulted in higher perceptions of self-reported learning. Whereas individuals working alone on-line tended to be less motivated, perceive lower levels of learning, and score lower on the test of mastery. In CSCL, researchers usually distinguish two types of interactions between learner-tutor and learner-learner. The first one, synchronous interaction, requires that all participants of interaction are on-line at the same time. Examples include Internet voice telephone, video teleconferencing, text-based chat systems, instant messaging systems, text-based virtual learning environments, graphical virtual reality environments, and net based virtual auditorium or lecture room systems. Synchronous interaction promotes faster problem solving, scheduling and decision making, and provides increased opportunities for developing.

3.2.2.2 Knowledge Representation Tool

Knowledge representation tool help learners to visually review, capture, or develop knowledge. Curriculum tools rely primarily on a text-based, syllabus approach to describing course content. This approach often fails to delineate the relationship of concepts and skills covered in one course to those covered in another. It also fails to show the knowledge base that a learner will have acquired at the end of his/her course of study. A visualization tool can engage both learners and instructors in an active learning process when they construct spatial semantic displays of the knowledge, concepts, and skills that the learner possesses and acquires. The e-Learning evolution proposes a good number of tools assisting the instructional designer during the analysis, design, implementation, and delivery of instruction via the Web. If on one side an automated support should be provided by authoring tools, on the other side these tools should implement suitable e-learning process design methodologies.

3.2.3 Identifying and defining the objectives for a solution

The identification and defining of the objectives were slightly changed but still based on those of the old desktop version of the Mwalimu OER but the main objective that mobile web application version aimed at and what we emphasized was to make a unique mobile web responsive study tool that is different from the already existing ones such as Hospice Africa Uganda E-learning, hybrid e-learning for rural secondary schools in Uganda, KIU e-learning platform for Kampala International University, UCU e-learning platform for Uganda Christian University, MUBS e-learning platform (musep) for Makerere University Business School, MUELE Makerere University E-learning Environment for Makerere University, Cyber schools and Gayaza High School eTutor which are one of the trending e learning platforms for higher institutions and well performing high schools. The main objectives for this mobile web application are as analyzed below;

- To increase and familiarize the use of mobile hand-held devices such as smart-phones, tablet computers, Personal Digital Assistants PDAs, palm-tops and many other mobile devices in education and also to show how the students and teachers use their mobile devices.

- To support student centered learning. In this aspect the mobile web Mwalimu platform acts as a virtual teacher with whom students interact freely like as if they are charting or texting on their mobile devices while learning on their own.

- To promote crowd sourcing of content as a means of assimilating small contributions into high quality content. Apart from the examinations area, the rest of the content areas on the mobile web Mwalimu platform are crowd sourced. Most importantly, through crowd sourcing of content, students become contributors to learning and not just recipients of knowledge. For example writing a book is a difficult process for one or a few persons to cope with, yet under the book bank area in Mwalimu mobile web platform, contributors can write just one topic or even a sub-topic and users simply select available content and download a book dynamically.

- To promote open access to content not only on computers but also mobile devices. Content on the Internet or web and its access is free however some e-learning platforms tend to have some financial charges for their content to be downloaded and viewed by their users. Therefore the Mwalimu platform aims at providing content for free to student who use the platform.

3.2.4 Design and development

The initial prototype of the Mobile web Mwalimu platform version was built using several web frameworks. Our team decided to split the development process into two that is to say the back-end and the front end. For the back end we used a popular PHP and MySQL framework known as laravel and for the front end or client side we used client side mark-up and programming languages such as HTML5, JavaScript and CSS and the client frameworks we used are mobile first css and JavaScript framework that has lately conquered the web

known as BOOTSTRAP and JQUERY. For better appearance of the interfaces the photos and different logos used we decided to use photo shop.

3.2.5   Searching and selection procedures

Our team completed the search for relevant literature in two stages. First, we examined peer reviewed articles that we found in electronic databases using keyword searches including mobile learning, wireless learning, and hand held devices. We used Academic Search Premier, Business Source Premier, Communication and Mass Media Complete, Library, Information Science and Technology Abstracts, and Psych ARTICLES. In the second stage, we used the "snowball" method by searching for journal articles, as well as articles presented in peer reviewed conferences that are cited in some of the articles that we had read. Altogether, as at 16 March, 2015, we read 15 articles and deleted 3 where each individual was allocated to 5 of the articles. The 3 articles were discarded because they were opinion papers, conceptual articles, non-empirical descriptions of program implementations, and literature reviews.

Chapter 4

System Design and Implementation

This chapter presents the mobile web version of the Mwalimu platform conceptual architecture and logical design and its features and describes a detailed description of the problems for the proposed system, the techniques and procedures for developing the new system and its implementation.

4.1 The architecture of the Mobile web version of Mwalimu study tool

Our team designed this mobile application to have four content areas that is to say question and answer, video lessons, examination and solutions and e-books. Within this architecture the users access all the four content areas and are therefore able to download and upload notes (crowd-sourcing). The subject consultant plays roles such as verification and validation of the notes, questions and answers uploaded by students. The user selects the notes on different subjects available on the book bank content area after which he / she is able to download them by simply clicking on a green download button. As it was earlier discussed in the previous chapter the mobile web version of the Mwalimu OER also continues to stress the fact that resources on this platform are free of charge and no user is required to pay for the content provided, the platform is also geographic independent and also strengthens students learning and teachers' knowledge.
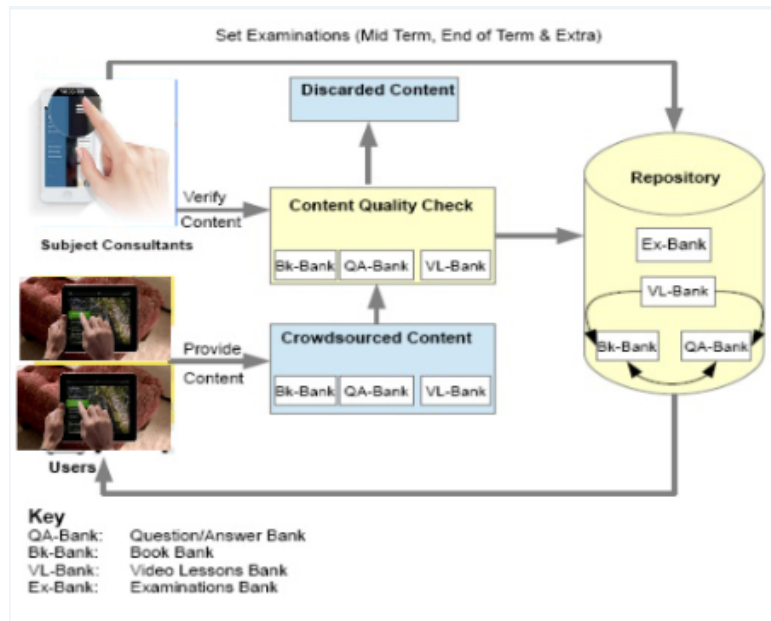
Figure 4.1: The Architecture of Mwalimu OER

4.2 Logical design of the Mobile web version of the Mwalimu platform

The Fig 4.2 shows the data model and the relationships between the data units and specifies the data flows.
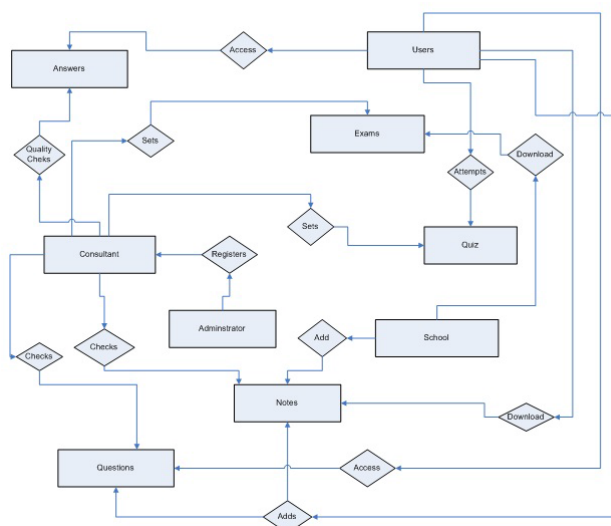

Figure 4.2: The logical design of OER

4.3 Technical features

4.3.1 Responsive web design

Our team chose to use the popular mobile first CSS framework to make all the features of the application appear responsive irrespective of the device width of the hand held mobile device. Custom cascading style sheets were used to achieve some custom views to suite the application needs. The Fig 4.3 shows both the desktop, tablet and mobile view of the application.

Figure 4.3: Responsive Web design Tablet and Mobile view

4.4 Existing Systems

The current version of the mwalimu OER in existance and accessible is the is a desktop version. However this version has a few limitations

4.4.1 Limitations of the desktop version of the Mwalimu OER

- The interface should have looked better.

- It is not a fully responsive for all mobile devices.

- It is mostly accessed by computers PC's than mobile devices.

4.5 The proposed system

A mobile web application version is a solution to the above mention limitations

4.5.1 The advantages of the proposed system

- Fully responsive and scales to all mobile devices.

- Friendly and easy to use user interface

- It can be accesed via a computer and mobile devices

Chapter 5

The Mobile web application of Mwalimu OER and students centered learning.

5.1 The role of the mobile web application of the Mwalimu OER in student centered learning

The mobile web application of the Mwalimu OER contributes a lot in students centered learning through various ways as some of which are analyzed below. Provision of questions and answers to students at any time they need. Students are able to download notes which they read then questions which they attempt and finally upload question from sections which they do not understand using their mobile devices which they carry almost every where and all the time.

As a result students tend to gain confidence after attempting the majority of these questions hence reducing examination fever and pressure resulting. Provision of video lessons by the book bank content area. The mobile web application of the Mwalimu OER has this done in a very conducive mobile friendly view where students that hate reading can understand from video tutorials uploaded by experts in the field. This is because the majority of the students understand by seeing something being done. The Mwalimu resources provide horizontal learning experience through student to student interactions and vertical interactions through teacher to student learning. The platform also provides a functionality for students who continuously attempt the questions to monitor the progress of their learning. However these category of students need to have logged in to their accounts that is to say they must have registered for an account on this platform which is free of charge.

5.2 Crowd sourcing and students on the Mwalimu mobile web application

The mobile web application of the Mwalimu OER gives an opportunity to its users to upload contents such as notes, question or quiz, answers and it does it

through the following ways;

1. Through the question/answer bank. This content area provides students with test areas where to ask questions according to subject and topic and then upload. The notes are verified by the subject consultant before finally uploading them to the platform for use.

2. Through the video bank. This content area allows students to upload video tutorials. However students may tend to upload any video therefore our team set up some verification to be done by the subject consultant before the video is finally ready for use on the platform. In effect due to the introduction of ICT in secondary schools the mobile web application of the Mwalimu OER helps students to express their ICT skills.

Chapter 6

Development of the mobile web version of the Mwalimu OER and discussion of results

6.1 Development of the mobile web application of Mwalimu OER

The development of the mobile web version of the Mwalimu OER is mainly centered on achieving a mobile view of the features that originally exit in the desktop version, however some features on the desktop version may not be achieved as desired on a mobile device. For example the book bank content area users of the application on a mobile device are required to scroll horizontally to view each column of the table as shown in fig 6.1.
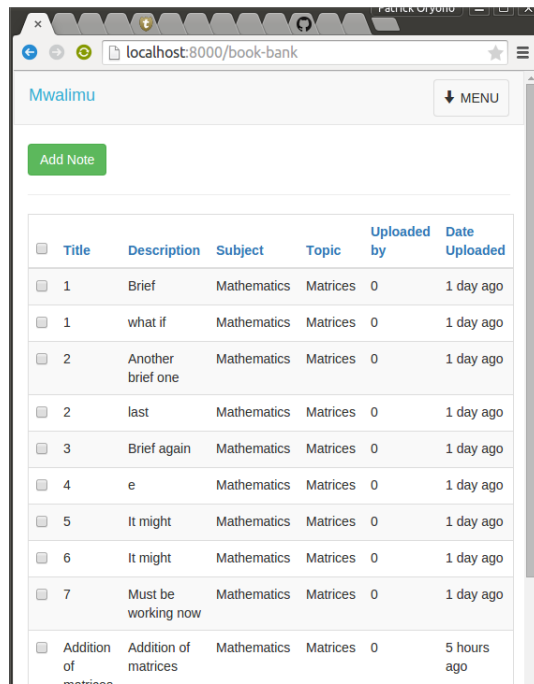
Figure 6.1: Responsive Book bank page

6.2 Mobile and desktop Interfaces

The main aim of this study is to achieve a responsive mobile friendly interface. The desktop version comprises of a home page with various tabs such as the four content areas that is to say the video bank, question/answer bank, book bank, exam bank, the search area and the user section on the top right corner. The main interface features of both desktop and mobile versions are;

1. Desktop version interface The desktop interface comprises of all the tabs that link you to different content areas, the search area and the user which is located on the top right corner. The user has a drop down that has two functionalities the login and settings. Fig shows the desktop interface

2. Mobile Version interface The mobile interface collapses all the tabs such that they feet on any mobile device's width and a it has a menu button at the top right corner that triggers the navigation to drop down vertically as shown in Fig.6.2.
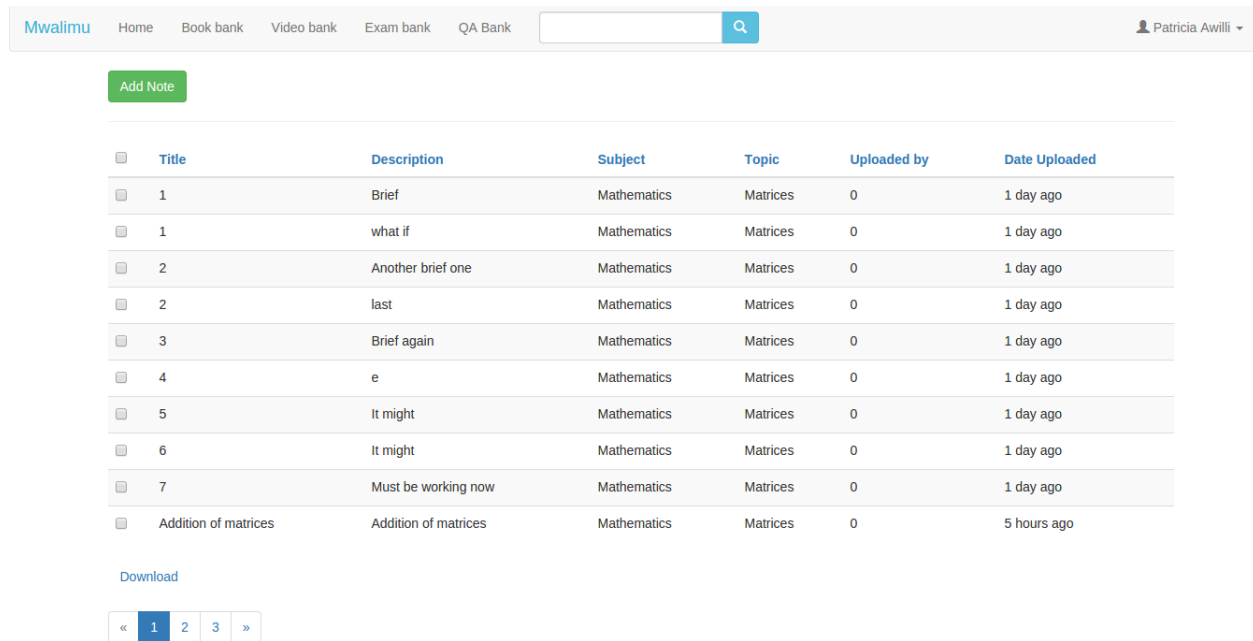
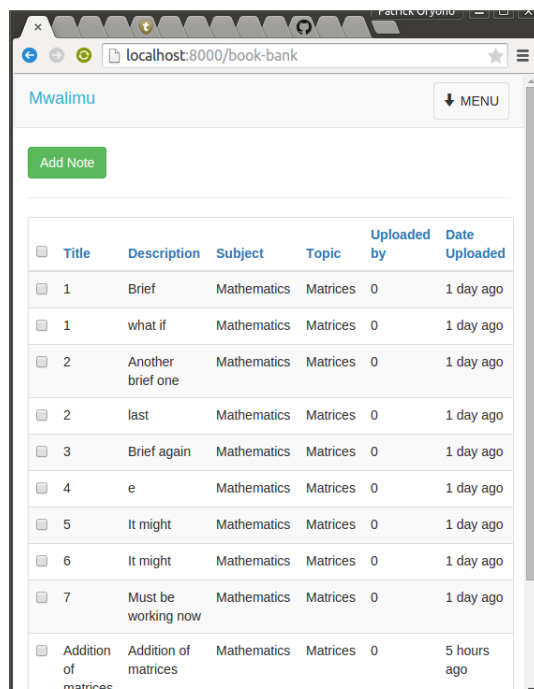Figure 6.2: The book bank area on desktop

Figure 6.3: The book bank on mobile

6.3   The Question / Answer bank content area.

This area consists of the following parts;

1. Links that give the user quick access to answered questions for each subject.

2. The submit question button. This gives the user access to both answered and unanswered questions. Some of the content here is got through crowdsourcing. The fig 6.4 shows the question / answer content area.

Figure 6.4: Q&A content

6.4   The Book bank content area

This content area is where students download notes according to their level and subject that suits them. The fig 6.5 shows the mobile view of the book bank content area.

Figure 6.5: Book bank content

6.5 The subject consultant roles

The major role of the consultant on this platform is to carry out validation and checking of the uploaded content such as videos, answers and notes are the ones required to be displayed to the rest of the users. The consultant also performs the following activities;

1. To review and approve the notes crowd-sourced from the users. Consultants are expected to improve the quality content such that it is the same a the national curriculum.

2. To review and approve questions and answers uploaded by the users. Consultants review questions that are poorly constructed and answers that are wrong.

3. To upload examinations and provision of marking guides.

4. To upload video lessons of their own and those from the crowd.

Chapter 7

Conclusion, Future work and Recommendations

7.1 Conclusion

The mobile web application of the Mwalimu OER enables and supports students to learn at their ow irrespective of their teachers' incompetence and inaccuracy such as through uploading wrong marking guides to question papers. In the mobile version of the Mwalimu OER the volume of the content is the responsibility of the crowd or users and the verification of the content is the responsibility of the subject consultant. If more students, teachers and schools enroll in themselves in the use of the Mwalimu web application, it will improve on the academic performance of students and increased access to highly qualified and experienced teachers and rich content since the crowd would be have also increased in size. This will make students academic performance not to be based on teachers competence but rather lack of Internet access.

7.1.1 Anticipated outcomes

1. Increased access to hand-held mobile devices such as smart phones, tablets and Personal Digital Assistants PDA in order to access the platform at any time by students whenever they are free.

2. Increased access to internet. Users shall be expected to increase their access to internet usage since the platform requires an internet connectivity to access it.

3. Improvement in ICT skills of the students and its other users. Interaction with this platform will help students be able to improve and adapt more skills in ICT

4. Reduced impact of teachers' incompetence to students. This is because the platform would have more experienced teachers at their disposal.

7.2   Future work

The team's future work is to improve the mobile web application of the Mwalimu OER architecture to achieve real time feedback by full time engagement of the subject consultant. The proposed architecture would be as shown in Fig which would be implemented in the future.

The architecture will transition the platform for enabling human to human interaction and human to hand-held mobile devices not as it is in the current architecture.
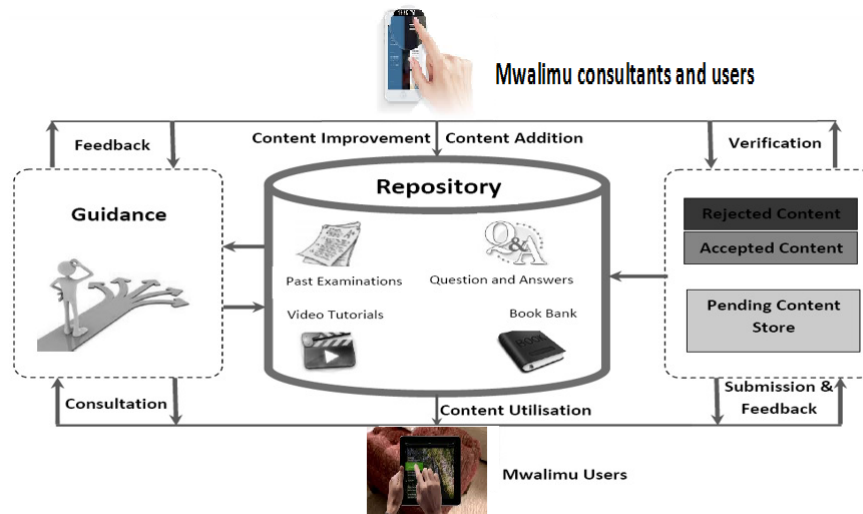

Figure 7.1: Future Architecture of Mwalimu OER

7.3   Recommendation

We recommend that the Mobile Web application version of the Mwalimu OER should be adopted by both rural and urban secondary schools to help improve on the academic performance of students.

To also improve on the ICT skills amongst secondary school students since ICT has been introduced into secondary schools.

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